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QUARTERLY PROGRESS REPORT, APRIL 1-JUNE 30, 1970

Federal Water Pollution Control Administration
Corvallis, Oregon

June 1970

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QUARTERLY PROGRESS REPORT

PACIFIC NORTHWEST WATER LABORATORY CORVALLIS, OREGON

APRIL 1—JUNE 30, 1970

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FEDERAL WATER POLLUTION
CONTROL ADMINISTRATION
NORTHWEST REGION

CLEAN WATER

41

PACIFIC NORTHWEST WATER LABORATORY

QUARTERLY REPORT

April 1 through June 30, 1970

United States Department of the Interior
Federal Water Quality Administration
Northwest Region, Corvallis, Oregon

June 1970

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NATIONAL COASTAL POLLUTION RESEARCH PROGRAM

910101/1607

Status of Projects and Significant Accomplishments

Ocean Outfalls

Final copies of "Ocean Outfall Design: Part I" have been received and initial distribution made. Work continues on Part II of the State-of-the-Art Report which will cover design and performance evaluation guidelines.

A draft report, "Forced Plumes in Stratified Quiescent Media," is near completion. It will be offered to a technical journal for publication.

A procedure was established for tracing of Kraft mill effluent from an ocean outfall by constituent fluorescence. A paper describing the method was submitted to Water Research for publication.

Barge Disposal Systems

A review draft of the state-of-the-art report has been completed, reviewed by the Program Chief, and returned to the author for additional review and reworking.

A day-by-day diver's schedule was provided the Tektite II office to assist in planning use of their 100-foot-deep environment near St. Johns, Virgin Islands. Nominations of program personnel were approved by headquarters for participation in the study, which will take place this fall.

An RFP draft for development of tracer methods for solids discharge, has been awaiting action at headquarters since August 1969.

Estuarine Modeling

Final copies of the laboratory report, "Mathematical Model of the Columbia River from the Pacific Ocean to Bonneville Dam - Part I: Theory, Program Notes and Programs," were received and distributed. The author presented a synopsis of his work on the mathematical model at a session of the Pacific Section, ASLO Meeting, in Berkeley, California. Work continues on Part II, which will describe verification and input/output procedures.

Reaeration

A paper entitled, "Field Studies in Yaquina River Estuary of Surface Gas Transfer Rates," was presented at the joint FWQA - Georgia Institute of Technology Symposium and Demonstration, "Direct Tracer Measurements of Reaeration Capacity of Streams and Estuaries."

NTA

a. A statement of need and workplan 16070 ZAJ, "Fate of NTA in Coastal Waters," were prepared and submitted to headquarters.

b. We have begun to collect and review articles published in the journals describing the early work with degradation of NTA, especially in reference to studies in coastal environments.

c. Equipment has been set up at the Oregon State University Marine Science Center for fate studies in the estuarine simulator, and at Corvallis for degradation rates in salt water using a compensated Warburg

respirometer. Preliminary efforts have been initiated to conduct radioactive tracer studies at the Marine Science Center.

d. Zinc-Zincon method has been found to be inadequate for determination of NTA concentrations in salt water. Consolidated Lab Services personnel are attempting to develop an alternative procedure for this determination.

e. BOD tests have been conducted to determine the rate of oxygen uptake by various NTA-acclimated and unacclimated seeds in salt water from two different Pacific Coast locations.

Trace Materials

A request was made to the Radiation Safety Committee of Oregon State University for our program to conduct, with their assistance and facilities, studies in the following areas: gas dynamics in estuaries; trace elements in disposal areas; kinetics and compartmentalization study of certain organic compounds in a laboratory environment simulator; oil pollution by passive and active tagging and activation analysis.

Oil Pollution

Program staff prepared two reports at the request of the Director, Division of Applied Science and Technology, as a basis for extending Alaska's 50-mile prohibitive zone (see "Reports and Papers").

Consulting Services

At the request of the Northwest Regional Office, NCPRP staff provided

comments and suggestions on the Office of Technical Programs "Guidelines for Bacteriological Surveys of Domestic Waste Discharges into Marine and Estuarine Waters."

NCPRP consulted with Middle Atlantic Regional Office regarding the impact of the Chesapeake-Delaware Canal enlargement on water quality in the Chesapeake Bay.

NCPRP staff reviewed a report from the Edison lab entitled, "Problems with the Use of Chemical Dispersants for Handling Oil Spills," and a copy of proposed rules for use of dispersants in ocean waters. Statements of need were prepared including these items.

At the request of the Northwest Regional Office Technical Programs' group, NCPRP staff provided an analysis of the outfall design of the Trojan Power Plant.

Equipment and Instrumentation

A model-T Coulter Counter was ordered for use in studies of water pollution associated with distribution of particulates in various areas, as well as for other program projects.

Justification was given for construction of a towing channel water flume for hydraulic studies, to be used by the Thermal and Coastal programs.

An invention rights questionnaire and report of invention were submitted on the saltwater environment simulator built by coastal staff stationed at Newport.

The research vessel HAROLD W. STREETER, which was owned and operated by the Northwest Regional Office, was transferred to the Coastal Pollution

Research Program. The Bureau of Commercial Fisheries is also interested in using the vessel and has agreed to provide dock space, routine maintenance and repair, and an operator for Coastal Research sampling trips in Puget Sound, in exchange for use of the vessel at other times.

A pulse height analysis system for use in neutron activation analysis of trace elements in various samples is still in the procurement and setup stage and is located at the Oregon State University Radiation Center. The equipment is almost all in place; a few items are still to be delivered, and initial operation is anticipated early in Fiscal Year 1971.

Grant and Contract Research

State-of-the-art Report on Estuary Modeling

The second estuary modeling conference was held at Salishan Lodge, Gleneden Beach, Oregon, May 6-7, and was attended by 30 consultants, FWQA representatives, and members of the Tracor staff. A draft of the final report was received and is under review.

Grant and Contract Applications

The following subjects of research proposals were reviewed:

1. A Proposed Program to Investigate the Technical and Economic Aspects of Thermal Pollution Control for Desalination Plants, 16130FSA.

2. Oceanographic Investigations of the Fate and Effects of Effluents Released into Marine Waters of the Pacific Northwest, 16070EOK.

3. Manipulation of an Urban River Estuary Ecosystem, 18050FXE.

4. The Effects and Extent of Pollution in San Diego Harbor, (preproposal).

5. Ocean Disposal on the Continental Slope, 16070EOI.

6. The History of DDT in the North Pacific Ocean, 16040GCF.

7. Biological Control of Microbial Pollutants in Natural Waters, 16050FRR.

8. Limiting Nutrients and Temperatures for Southern California Coastal Phytoplankton, 18050FRA.

9. Oxidation of Organic Matter in the Seabed, 16070EKZ.

10. Conference on Dredging and Environmental Quality, 15070CDK.

Reports and Papers

Extramural Research

1. List, E. John, "Laminar Momentum Jets in a Stratified Fluid," Journal of Fluid Mechanics, accepted for publication April 1970.

2. "Interim Presentation by Florida Ocean Sciences Institute to the Governor's Committee on Ocean Outfalls," Palm Beach County Health Department Auditorium, West Palm Beach, Florida, April 10, 1970.

3. Lukin, Lawrence D., "Demonstration of the Limitations and Effects of Waste Disposal on an Ocean Shelf," Final Report to FWQA, 16070EFG, April 30, 1970 (draft).

4. Pamatmat, Mario M., "Oxidation of Organic Matter in the Seabed," Annual Progress Report to FWQA, 16070EKZ, April 1970.

5. Espey, W. H. and G. H. Ward, Ed., "Estuarine Water Quality Modeling: An Assessment," Final Report to FWQA, 16070DZV (draft).

Inhouse Research

1. Baumgartner, D. J. and D. S. Trent, "Ocean Outfall Design - Part I: Literature Review and Theoretical Development," FWQA Northwest Region, Pacific Northwest Water Laboratory Report, Portland, Oregon, April 1970. 129 p.

2. DeBen, W. A., "Design and Construction of a Saltwater Environment Simulator," FWQA Northwest Region Working Paper 71, Portland, Oregon, April, 1970. 30 p.

3. Baumgartner, D. J., M. H. Feldman, and Carl L. Gibbons, "A Procedure for Tracing of Kraft Mill Effluent from an Ocean Outfall by Constituent Fluorescence," submitted to Water Research June 1970.

4. Feldman, M. H., "Trace Materials in Wastes Disposed to Coastal Waters," FWQA Northwest Region Working Paper 78, in press.

5. Callaway, R. J., "Summary of the Oceanography and Surface Wind Structure of the Pacific Subarctic Region in Relation to Waste Releases at Sea," FWQA Northwest Region Working Paper 76, in press.

6. Feldman, M. H., "The 50-mile Ballast-Oil Dumping Prohibited Zone off Alaska Reconsidered in the Light of Available Data Gleaned from Significant Incidents," FWQA Northwest Region Working Paper 77, in press.

7. Baumgartner, D. J., M. H. Feldman, L. C. Bentsen and T. L. Cooper, "Field Studies in Yaquina River Estuary of Surface Gas Transfer Rates," presented at FWQA-Georgia Institute of Technology Symposium and Demonstration, July 7-8, 1970.

Plans for First Quarter, FY 1971

Approved workplans have been received, and, if not already underway this fiscal year, work will begin on the following topics:

1. Fate of NTA in Coastal Waters.
2. Estuarine and Ocean Outfalls.
3. Interaction of Pollutants in Marine Environment and Impact on Water Quality.
4. Barge-dump Disposal of Wastes in Ocean and Coastal Waters.
5. Fate of Coliform Bacteria in the Marine Environment.
6. Effectiveness of Various Treatment Processes on Removal of Microorganisms including Viruses.
7. Mathematical Models for Stratified Portions of Estuaries.
8. Vertical Distribution of Properties in Fiords.

NATIONAL EUTROPHICATION RESEARCH PROGRAM

910101/1601 and 910102/1601

In cooperation with the Minnesota Pollution Control Agency, Dr. Bartsch carried out a eutrophication reconnaissance of Albert Lea Lake, Minnesota, and prepared a report of steps necessary to restore the quality of the lake.

Dr. Bartsch appeared as a witness in the reconvened Lake Superior Enforcement Conference in Duluth, Minnesota.

General

A. R. Gahler attended the meetings of the International Association for Great Lakes Research at Buffalo, New York, in April.

Also in April Thomas E. Maloney traveled to Winnipeg, Canada, to discuss with Canadian scientists their ongoing and proposed research to identify areas of cooperative research between the United States and Canada.

John Tilstra spent one week during May consulting with grantees and other agencies involved in the Lake Sallie, Minnesota, weed harvesting study.

Kenneth Malueg spent one week during May at FWQA Headquarters in Washington, D. C., working on grant proposals in Arnold Joseph's office.

Mr. Brice has devoted a great deal of time to planning for the full-scale phosphorus removal tertiary plant to be constructed at Ely. He has been called upon for a great deal of liaison work between our

agency and the City of Ely, the State of Minnesota, consulting engineers, and other Federal agencies. In May he attended the second AWT planning meeting in Cincinnati.

Donald Schults spent several days during June at Dr. Goldman's Lake Tahoe station to become familiar with techniques for in situ ^{14}C work.

In June Thomas Maloney and Daniel Krawczyk met with Headquarters and Southeast Water Laboratory personnel to discuss and finalize the proposed research plan to evaluate the roles of carbon and phosphorus in eutrophication. Later in June Messrs. Maloney and Powers attended a meeting at the Pacific Southwest Regional Office regarding accomplishments of Lake Tahoe R & D Grants' findings.

Status of Projects and Significant Accomplishments

Activity during this quarter has been dominated by planning for and activation of NTA-oriented research. NERP's effort with respect to the ecological effects of NTA centers around algal growth stimulation and NTA-sediment interactions. Studies are being made on several lakes of various trophic states to determine the effects of NTA on ^{14}C uptake. These are being correlated with laboratory algal assays. A study of longer term effects of NTA are being made utilizing 16 foot square plastic basins in eutrophic Cline's Pond. In situ algal assays are also being conducted at the Shagawa Lake Project using 80-gallon plastic bags. NTA-sediment interactions are being studied in the laboratory.

ECOLOGICAL CONTROL BRANCH

Nutrient Control. Studies involving ^{14}C uptake are being made on Waldo Lake (oligotrophic), Triangle Lake (mesotrophic), and Cline's Pond (eutrophic). Epilimnetic water is spiked with NTA, NTA-containing secondary and tertiary domestic waste effluents, nitrogen, and phosphorus, to evaluate the short-term effects of NTA on algal growth.

The cooperative study with U. S. Forest Service on Waldo Lake has been resumed, but work was delayed until late June by snow accumulations. Wells are presently being drilled for determining groundwater movement and the lake monitoring stations of 1969 have been sampled.

The Albany lakes were sampled in April as part of our continuing program to characterize those bodies and assess their potential as experimental lake restoration sites.

Investigations on nutrient uptake by acquatic macrophytes, utilizing radioactive phosphorus, show that uptake through stem and leaf portions of Potamogeton greatly exceeds that through the roots.

Sediment-Water Interchange. Cline's Pond studies on NTA and nutrient inactivation are being made using large plastic basins. Three basins, each about 16 feet square and open at the bottom, isolate a volume of pond water and sediment. One is used as a control, one has received 5 mg/ℓ NTA, and the third has been treated with alum and sodium hydroxide in a nutrient inactivation experiment.

Characterization of lake sediments, and aquarium studies of reaction of benthic organisms to aluminum, lanthanum, and zirconium (nutrient inactivation materials) were conducted.

Arnold Gahler is, in addition, carrying out an investigation to develop gas chromatographic techniques for sensitive determination of NTA. Robert Tyo is working with Mr. Gahler on this project.

Shagawa Lake Project. The regular year-round monitoring program on Shagawa Lake and its tributaries has continued. NTA-oriented algal assay experiments utilizing Burntside River water in 80-gallon bags was initiated in May. Algal growth stimulation by NTA does not appear to occur until at least a week after its introduction into the water, and then only in the presence of additional phosphorus. Both P and N are quite low in the Burntside River at this time.

Physiological Control Branch

The evaluation of Selenastrum capricornutum as a test organism for the Provisional Algal Assay Procedure was continued. Studies on samples from the Shagawa Lake project continued with emphasis on growth response assays of secondary and tertiary effluents before and after clinoptilolite treatment to remove ammonia nitrogen. Algal assays were completed on the Albany, high Cascade and coastal lake samples collected in April. Carbon studies using modified PAAP medium, Shagawa Lake and Burntside River water were completed. Bioassays (PAAP) were initiated in accordance with the NTA research plan using synthetic medium (with and without nitrogen) and water samples from Cline's Pond, Triangle and Waldo Lakes.

Secondary effluent obtained from the Shagawa Lake project supported 80 mg/ℓ dry weight of Selenastrum capricornutum. After treatment with clinoptilolite the secondary effluent supported only 40 mg/ℓ dry weight

of the test alga. Ninety percent of the ammonia nitrogen was removed from the secondary effluent by clinoptilolite treatment. However, sufficient nitrate nitrogen remained to support algal growth. Tertiary effluent (lime) supported 0.24 mg/ℓ dry weight of the test alga before clinoptilolite treatment and 0.28 mg/ℓ dry weight after treatment.

Carbon concentrations (as $NaHCO_3$) of 0, 3, 6, 12, and 24 mg/ℓ were added to the Mod V algal culture medium containing total nitrogen (as $NaNO_3$) of 1.5 mg/ℓ, total phosphorus (as K_2HPO_4) of 0.1 mg/ℓ, iron 0.32 mg/ℓ; trace metals deleted, and the Na_2EDTA reduced to 1.0 mg/ℓ, and evaluated under standard (PAAP) conditions. No difference in the 14-day yields of Selenastrum capricornutum (40 mg/ℓ dry weight) could be ascertained between the range of carbon additions. Carbon additions of 10 and 20 mg/ℓ (as $NaHCO_3$) were added to Burntside River and Shagawa Lake water samples, and assayed under standard PAAP conditions. Neither Burntside River nor Shagawa Lake water samples responded to 10 mg/ℓ additions of carbon. Burntside River control supported 0.10 mg/ℓ dry weight of the test alga while Burntside River plus 20 mg/ℓ carbon supported 0.14 mg/ℓ dry weight of the test organism. Shagawa Lake water was not stimulated by the addition of 20 mg C/ℓ .

NTA additions of 0.1, 0.2 and 0.5 mg/ℓ did not inhibit the growth of Selenastrum capricornutum grown in 30% PAAP medium containing nitrogen. NTA degradation in the lower concentrations (0.1 - 0.5) was 80% complete by the 10th day of incubation. NTA concentrations of 1.0, 2.0, 5.0, 10, 15 and 25 mg/ℓ inhibited the growth of the test alga in 30% PAAP medium containing nitrogen. NTA additions of 0.1 to 25 mg/ℓ in 30% PAAP

medium without nitrogen did not stimulate growth of the test organism during the 21-day incubation period.

Grant and Contract Research

Technical reviews of proposals for research and demonstration grants, and contracts were provided for the following subjects:

1. Organic Phosphorous in Eutrophic Waters.
2. Electrolytic Methods for Algal Pollution.
3. Zonal Centrifugation as Applied to Nutrient Status of Sediments.
4. An *In Situ* Evaluation of Nutrient Effects in Lakes.
5. Analysis of a Pollution-Free Environment of the Great Lakes.
6. Feasibility of a Direct Index for Sediment Distribution in Lake Erie.
7. Proposals from the Office of Water Resources Research, USDI, Washington, D. C.
8. Eutrophication of Surface Waters - Lake Tahoe (Indian Creek Reservoir).
9. The Role of Surface vs. Sub-Surface Waters in the Rate of Eutrophication.
10. Water Quality and Eutrophication of Seeley Lake, Montana.
11. The Role of Sludge Worms in Promoting Eutrophication.
12. Phosphorus in Aquatic Ecosystems.
13. Mechanism of Algae Inhibition from Lime-Precipitated Wastes.
14. Limiting Nutrients and Temperature for Southern California Coastal Phytoplankton.
15. Biological Control of Microbial Pollutants in Natural Waters.

Plans for First Quarter, FY 1971

NTA work will continue as the priority area throughout the quarter. The Waldo Lake limnological monitoring study will continue on a monthly basis, and the groundwater investigation there will be pursued. The Sediment-Water Interchange Section will begin laboratory studies of NTA-sediment interactions. The Albany Lakes will be monitored in July if time permits. At Shagawa Lake, algal assay experiments will continue throughout the summer. Assays will include Shagawa Lake water as well as Burntside River water.

NATIONAL WASTE TREATMENT RESEARCH PROGRAM

FOOD WASTES RESEARCH - PPB 1206

Status of Activities and Significant Accomplishments

Approximately 225 people attended the three-day National Food Waste Treatment Symposium April 6-8, which was conceived by the Pacific Northwest Water Laboratory and co-sponsored by National Canners Association; Northwest Food Processors Association; Agriculture Research Service, USDA; and FWQA. The Proceedings are being reproduced and will be distributed the first quarter of FY 71.

An Engineering Committee Meeting of the Potato Processors of Idaho Association in Burley, Idaho, was attended.

The status of five grants was reviewed during onsite visits. These included: Snokist Growers, Yakima, Washington; City of Tualatin, Oregon; City of Grand Forks, North Dakota; Western Potato Service, Inc., Grand Forks, N.D., and North Star R&D Institute, Minneapolis, Minnesota.

Mr. Burm attended a seven-day training course titled "Biological Treatment Technology" and gave two lectures in the course.

Mr. Dostal attended the "Second International Symposium for Waste Treatment Lagoons", Kansas City, Missouri, and presented a paper titled "Aerated Lagoons for Potato Processing Wastes".

Two continuous-flow, bench-top, activated sludge pilot plants were fabricated and placed in operation. Both will be fed settled

domestic sewage at a rate of about two liters per day. One of the feeds will be spiked with 5 mg/l of trisodium nitrilotriacetate (NTA). Effluent from both units will be collected for additional testing by the National Eutrophication Research Program (NERP). Current Plans call for operation of these units for six months.

Grant & Contract Research

The following grant proposals and preproposals were reviewed during the quarter:

1. Polyurethane Foams from Dried Cheese Whey--12060 FUD.
2. Demonstration of a Process for the Abatement of Pollution from Soy Protein Whey--12060 FUR.
3. Water and Waste Management in Sweet Potato Processing 12060 FRW(R-1).
4. Pollution Study of Wet Milling Industry.
5. Investigation of Spray Irrigation of Wastes from Wheat Flour Processing.
6. Pilot Plant Studies on Removal of Algae from High-rate Oxidation Ponds.
7. Joint Treatment of Domestic and Sweet Potato Processing Wastes.
8. A Comprehensive Pilot Plant Evaluation of the Activated Biofilter (ABF) Biological Waste Treatment System.
9. Use of Anaerobic Lagoon in Treating Frozen Food Plant Wastes.
10. Demonstration of Pulse Jet Drying of Shrimp Wastes.

11. Pilot Plant Evaluation of the Use of Oxygen in Activated Sludge Treatment of Joint Municipal-Industrial Waste.

Four grants were awarded during the quarter:

1. 11060 FJQ, City of Kodiak, Alaska, "Pollution Abatement & By-Product Recovery in Shellfish and Fisheries Processing--Phase I."

2. 12060 FQE, National Canners Association, Berkeley, California, "Dry Caustic Peeling of Tree Fruit to Reduce Liquid Waste Volume and Strength."

3. 12060 FJK, Ebinger Baking Company, Brooklyn, New York, "Optimization of Bakery Wastewater Treatment."

4. 12060 FLL, The American Distilling Co., Inc., Peking, Illinois, "Activated Sludge--Bio-Disc Treatment of Distillery Wastes."

Current Status of assigned (P.O.) grants is as follows:

1. 12060 EUZ "Winery Wastewater--Characterization and Treatment" Widmer's Wine Cellars, Naples, New York. Bids were received on the general construction contract and because they were about $200,000 over the estimate, the contract will be re-advertised for new bids following some modifications in the contract.

2. 12060 EKQ "Kent Cheese Company--Waste Treatment Facility" Kent Cheese Company, Melrose Park, Illinois. Feeding of process wastes plus whey to the aerated lagoons was initiated; the latter has resulted in anaerobic conditions in the first lagoon due to organic overload. Steps are being taken to reduce or eliminate the whey addition.

3. 12060 EHS "Cannery Waste Treatment by Lagoons and Oxidation Ditch" Melbourne Water Science Institute, Melbourne, Victoria, Australia. Field investigations have been completed and drafting of the final report is underway.

4. 12060 EHV "Aerobic Secondary Treatment of Potato Processing Wastes with Mechanical Aeration" The R. T. French Co., Shelley, Idaho. The operation was stopped upon completion of processing. Data collected during the past season is being evaluated to see if the grant objectives can be fulfilled without additional testing. During the next two months the floating aerators will be worked on in an attempt to find and correct the problems encountered during last seasons operation.

5. 12060 DSI "State-of-the-Art, Sugarbeet Processing Waste Treatment" Beet Sugar Development Foundation, Fort Collins, Colorado. A draft of the final report was reviewed and returned to Grantee for additional work.

6. 12060 ECF "Water Pollution Abatement in the United States Seafood Industry: State-of-the-Art" Oregon State University, Corvallis, Oregon. A draft of the final report has been reviewed. Following minor corrections it will be submitted for reproduction.

7. 11060 EZR "Complete Aerobic Treatment of Combined Domestic and Industrial Wastes with Mechanical Aeration," City of Dallas, Oregon. The plant continues to operate in a satisfactory manner with monthly average BOD and SS concentrations equal to or less than 10 mg/l.

8. 12060 EIG "Full-Scale Demonstration and Evaluation of Potato Dry and Wet Caustic Peeling Processes," Western Potato Service, Inc., Grand Forks, North Dakota. Some operational experience was obtained on two of the three "dry-peel" lines before processing ended for the season but the actual demonstration period will not start until mid-August. Installation of flow measuring and sampling equipment continues in preparation for next season's evaluation at both plants.

9. WP-01486-01 "Status and Research Needs for Potato Waste Waters", University of Washington, Seattle, Washington. Final report has been distributed and following an audit, the project will be closed out.

10. 12060 FAD "Pollution Prevention by Aeration of Fruit Processing Wastes", Snokist Growers, Yakima, Washington. The final report has been distributed and an audit has been done but the project has not been closed out as yet.

11. WPD-93-04-68 "Anaerobic-Aerobic Sugar Beet Waste Treatment" Beet Sugar Development Foundation, Fort Collins, Colorado. The first draft of the final report has not been submitted. Due to the long delay action has been taken by Headquarters to assure completion of the final report.

12. 12060 DXL "Reduction of Salt Contents of Food Processing Liquid Waste Effluent", National Canners Association, Berkeley, California. This project will demonstrate the effectiveness of an

ion exchange system for treatment of olive processing (brine) wastes. A 10,000 gallon per day pilot plant using calcium hydroxide as a resin regenerant will be used to determine economics and design criteria.

13. 12060 EDK "Production and Disposal Practices for Liquid Wastes from Canning and Freezing Fruits and Vegetables", National Canners Association, Berkeley, California. A state-of-the-art document will be developed and will include research needs in the subject area.

14. 12060 EHT "Use of Fungi Imperfecti in Waste Control", North Star Research & Development Institute, Minneapolis, Minnesota. Several strains of fungi were evaluated (bench-top) for their ability to degrade waste streams from the processing of corn and soy. The final report has been submitted to FWQA for reproduction.

15. 12060 EDZ "Pilot Plant Installation for Use of Fungi Imperfecti on Vegetable Wastes", Green Giant Company, LeSueur, Minnesota. Two 7,500 gallon pilot plants (aerated lagoon and oxidation ditch) will be used to continue the work done under 12060 EHT on a larger scale.

16. 12060 FAK "Concentration of Sugar Beet Wastes for Economic Treatment with Biological Systems", Beet Sugar Development Foundation, Fort Collins, Colorado. The first draft of the final report was reviewed and returned to Grantee for revision.

17. 12060 FQE "Dry Caustic Peeling of Tree Fruit to Reduce Liquid Waste Volume and Strength", National Canners Association, Berkeley, California. NCA in cooperation with USDA, will evaluate "dry caustic" peeling of apricots, peaches, and pears at pilot plant scale.

18. 11060 FJQ "Pollution Abatement and By-Product Recovery in Shellfish and Fisheries Processing--Phase I", City of Kodiak, Alaska. A 12-month project will evaluate various parameters involved in demonstrating the feasibility of recovering protein from various wastes by extraction with dilute sodium hydroxide. The sodium proteinate solution will be processed in several ways resulting in various types of protein product which will be evaluated.

Plans for 1st Quarter, FY 1971

1. Continue grant reviewing and monitoring.
2. Distribute Food Waste Treatment Symposium Proceedings.
3. Continue operation of bench-top activated sludge pilot plants for National Eutrophication Research Program.
4. Start pilot plants at Flav-R-Pac in Salem, Oregon using an Oregon State University graduate student under the "Graduate Fellowship Program"

PAPER & FOREST INDUSTRIES RESEARCH - PPB 1204

Status of Activities and Significant Accomplishments

Cooperative work on the Crown-Zellerbach Corporation, Lebanon grant continued during the period. Bench-scale studies on the effects of increasing phosphorus additions revealed both increasing rates of stabilization and improved secondary sludge sedimentation rates. This project will be completed in September 1970. Crown-Zellerbach is preparing a new R&D grant application for continued use of these facilities for added project work in the area of coliform and fecal coliform control

In-house bench-scale work was started on a project to determine the ability of flocculants and polymers to separate aerated lagoon secondary sludge from pulp and paper treated waste effluent. Lebanon and Halsey wastes were used This effort will eventually be expanded to include Weyerhaeuser at Springfield, Oregon, and Western Kraft at Albany, Oregon, if agreeable with mill management.

Dick Bauer of the Portland Regional Office has concluded, for the time, his effort determining the levels of coliform and fecal coliform in treated pulp and paper waste Samples were cultured for total coliform, fecal coliform, and fecal strep. Selected samples were forwarded to CDC in Atlanta for confirmation with identification of Klebsiella pneumoniae. Present data indicate that wastes from acid pulping and unbleached alkaline pulping are capable of supporting growth and multiplication of Klebsiella in treatment facilities.

Further work in-house, and through the grant mechanism, is planned.

In-house work with the RBC unit at Lebanon was discontinued to move the unit to Salem for studies on food processing wastes. Operations at Lebanon were less than satisfactory due to lack of hydraulic control. Changes will be made for future work. This unit will also be tried on final effluent as a means of separating fine floc from the aeration system.

The Beloit-Passavant microsieve unit has been at Weyerhaeuser Company, Longview, Washington, the majority of this period. WEYCO has used the unit to polish primary treated hydraulic barker wastes, receiving alum and polymer additions, for recycle to the barker. The WEYCO project staff is enthused with the results obtained. Extension of project work to include side-hill screens teamed with the mocrosieve, leads to the suggestion that classical primary sedimentation may be omitted at savings in capital and operating costs. These findings support the earlier reported research needs to examine, in-house, mechanical separation of primary and secondary suspended solids from the industry.

An agreement has been reached with Crown-Zellerbach for use of some space at the Lebanon mill for project work on mechanical separation of suspended solids. This project will get underway as soon as FY 71 funds are available.

Grant & Contract Research Studies

Research and Demonstration grant administration continued to

occupy a significant portion of the staff effort. A final report on the North Carolina State project was published in the quarter. All on-going projects received a program review during the quarter.

New project funded in 1204 during the quarter involved:

1. Esleeck Manufacturing Co.-Strathmore Paper Company, for a joint study of microsieve use in lieu of primary treatment at Turner Falls, Massachusetts.

2. S. D. Warren, Cumberland, Maine, received a grant for recovery and reuse of filler materials used in fine paper manufacture.

3. Green Bay Packaging at Green Bay, Wisconsin, received a grant for full-scale application of reverse osmosis to semi-chemical dilute liquor separation and disposal.

Plans for 1st Quarter, FY 1971

1. Continue in-house bench-scale work on flocculants and polymers with pulp and paper treated waste effluent from Halsey & Lebanon.

2. Extramural and in-house work with the Beloit-Passavant microsieve unit on pulp and paper waste sources in the Pacific Northwest.

3. Continue grant reviewing and monitoring.

NATIONAL THERMAL POLLUTION RESEARCH PROGRAM

910101/1613

Status of Projects and Significant Accomplishments

Work Plan ZFL: Consultation and Advisory Services

1. Provided additional information to Great Lakes Regional Office on Big Stone Lake -- in the form of revision of the preliminary engineering report which was prepared by Bechtel Corporation. Also, provided information at the request of Mr. Carl, Director of the Division of Sanitary Engineering, South Dakota Department of Health on information needed to make a technical evaluation of thermal power plant cooling water control system.

2. Dr. Garton and Dr. Tichenor provided information on Lake Michigan and thermal effects for Mr. Frank Hall (HQ, Washington, D. C.).

3. Manuscript for "Guidelines: Biological Surveys at Proposed Heat Discharge Sites" is in press in Washington, D. C.

4. Mr. Rainwater presented a paper on "Thermal Waste Treatment and Control" to jointly-sponsored meeting of Atomic Industrial Forum and Electric Power Council on Environment, Washington, D. C., June 29, 1970.

Work Plan ZFC: Heat Transfer and Behavior in the Mixing Zone

A. Insect Emergence Study:

One run of the experiment has been completed in which ten midges (Tanytarsus dissimilis Joh) were placed in the bottoms of each eight vertical glass columns six-inches in diameter and six-feet high. The

bottom ends of the columns were held at 70°F and the temperatures of the top layers were varied to simulate a hot layer such as could be produced by a thermal effluent, two of the columns were held at 70°F throughout the length, two columns were held at 80°F in the top section; two columns were held at 90°F in the top section; and, two columns were held at 100°F in the top section. After 48 days, a total of 563 midges had emerged from the constant temperature columns; 212 had emerged from the +10°FΔT columns; one had emerged from the +20°FΔT columns; and, one had emerged from the +30°FΔT columns. From these preliminary data, it appears that cool bottom waters are not sufficient to ensure survival of aquatic insects if they have to emerge through a heated layer. Additional experiments will be conducted to more closely define the lethal range for this midge and other insects will be used in later studies.

B. Multiple Buoyant Jets

The problem of multiple buoyant jets in an arbitrary density stratification that includes the effect of jet interference was analyzed by Tetra Tech Corporation. It is found that significant reduction of excess temperature at the free surface can be achieved by employing multiple port diffusers that are optimally spaced instead of discharging at the end of the pipe. The horizontal spreading of a heated effluent in a quiescent water was analyzed both for the steady state and time dependent situations. A significant finding in this study is the analytical predication of the onset on an internal hydraulic jump.

C. Grants and Contracts

No new research grants or contracts were added to this work plan

during the quarter.

Work Plan ZFD: Heat Transport and Behavior in Large Hydraulic Systems

A mathematical model and associated computer program for predicting the formation and maintenance of thermoclines in lakes and reservoirs has been completed by Cornell Aeronautical Laboratory. This model was subsequently used by Cornell Aeronautical Laboratory to determine the physical consequences of discharging warm water at or below the thermocline. Preliminary results indicate that both the stratification period and the volume of the epilimnion are changed when such discharges occur.

Researchers at Cornell University have investigated several wind profile models to determine their applicability under various conditions of atmospheric stability and water surface roughness. They have shown that the classical power law for wind profile, while less sophisticated than other models, is well suited for practical turbulent transfer calculations provided oughness and stability are properly defined. This work was done as part of a project designed to improve the accuracy of analytical techniques used to predict heat and mass transfer between the water surface and atmosphere.

The stochastic model development cooperative project with FWPCA's Systems Analysis and Economics Branch, Headquarters and the refinement of techniques for predicting stream evaporation project continue.

No new grants or contracts were added to this work plan during the quarter.

Work Plan ZFF: Engineering and Cost Aspects of Heat Dissipation

In a task II report by Dynatech Corporation the design and optimization of power plant were examined. Dynatech has presented the necessary cost/performance information required for power plant optimization and has programmed computational techniques which are currently used by power plant designers to arrive at the most economic solution. Only the turbine and condenser systems are examined in detail. The study concludes that data from task I and task II efforts could be incorporated into the total community study and arrive at reasonable cost evaluation of the latter.

In-house calculations were made for the treatment of a cooling pond with materials so that a major portion of the solar heat load would be reflected. The materials considered were granular or films applied to the water. The desired radiation properties for such materials are low absorptivity to solar radiation and high emissivity for long wave radiation. A mathematical model is developed to predict the performance of both treated and natural ponds. This model is then verified with a small scale field test. It shows that the treatment significantly reduces the evaporation loss. The model also shows that under certain conditions a reflective pond could cool the water to a lower temperature and with less area than a natural pond.

No new grants or contracts were added to this work plan during the quarter.

A paper by K. V. Byram and L. D. Winiarski, "Reflection Cooling Pond" has been accepted for presentation at the ASME Power Conference

New York, November 29 - December 3, 1970.

Work Plan ZFJ: Beneficial Use of Waste Heat

A demonstration grant was awarded Eugene Water and Electric Board for "Thermal Water Demonstration Project," which will involve several agricultural uses.

Work Plan ZFI: Advanced Technology for Power Generation and Utilization

A paper titled "Utility Application for Advanced Gas Turbine to Eliminate Thermal Pollution" by Frank Biancardi and G. T. Peters of United Aircraft has been accepted for presentation at the ASME Annual Meeting, 1970, New York.

BIOLOGICAL EFFECTS RESEARCH PROGRAM

Status of Projects and Significant Accomplishments

Columbia River Thermal Effects Study

A. Adult Salmon Studies: The final report is being prepared.

B. Tissue Enzyme Studies: Data collection phases are complete and the data are being analyzed; final report is in progress.

C. Temperature Effects to Toxicity: Data collection phases are complete and the final report is in progress.

Pacific Salmon Testing Facility

Site preparation and construction activities are about 55% completed. Manpower for these activities was furnished by this office on an emergency basis. Preliminary inquiries indicate this is the world's only facility for group testing of large adult salmon. However, the facility can be used for testing smaller fishes either in stream or pond conditions. It is hoped that the facility will be operational by this fall; shortages of key manpower and money threaten to delay its completion.

Clark Fork River Studies of Heavy Metal Criteria

This study was requested by the Northwest Regional Office of FWQA. Preparations for the field study are continuing. Laboratory pilot tests will be undertaken as an adjunct to the main study.

Waste Treatment Studies

The effects of wastes on the fertilization of Coho Salmon reached the stage where data collection phases were completed. A report is being drafted. Wastes studied were those from the sulfite and Kraft pulp and

paper industry, copper and ammonia.

New Development

This office has been transferred administratively to the National Water Quality Laboratory, Duluth. While our personnel will remain in Corvallis, our technical direction and assigned activities will come from Duluth. Therefore, our future activity reports will be incorporated into those of the National Water Quality Laboratory, Duluth.

CONSOLIDATED LABORATORY SERVICES PROGRAM

Status of Projects and Significant Accomplishments

General

NTA-Carbon studies were started The program was reinforced with the employment of five temporary employees to handle the extra work load

Production line techniques are being employed to handle samples originating in the Eutrophication Program from the NTA-Carbon studies.

A field gas chromatographic analyzer is being assembled and fabricated for use in field NTA-Carbon studies for the analysis of CO_2. A modular construction concept is being used so that the unit can also be adapted with proper columns and switching choices to analyze for other gases dissolved in water.

The NTA-Carbon studies required attendance at a number of meetings with PNWL, Headquarters, Southeast Water Laboratory, and industrial personnel.

The Technical Assistance Programs in the Northwest Region were responsible for samples for metal analysis.

Analytical Quality Control Charts have been prepared for the analysis of ortho and total phosphate at the Shagawa Lake project conducted at Ely, Minnesota

The Portland Laboratory has been put under the administrative and technical guidance of the Technical Assistance Program of the Northwest

Region.

Automated Analytical Systems

Ortho phosphate and NTA analyses using zinc-zincon are now being routinely run on the Technicon automated system. Samples for total phosphate are digested in an autoclave with sulfuric acid and potassium persulfate. After conversion of all phosphorus forms to ortho phosphate, the samples are processed through the automated system.

Further development work on automated Kjeldahl analysis has been halted due to the workload from the NTA-Carbon studies.

Specialized Analysis

The Kjeldahl analyses continue to be run using the semi-micro Aminco procedure. The use of two analysts in handling the Kjeldahl analyses has reduced the backlog so that immediate attention is provided to incoming samples.

Samples were analyzed for mercury using the colorimetric dithiozone procedure. Although the procedures are time-consuming, mercury can be detected at 0.005 mg/ℓ concentration.

Further refinements for the analysis of arsenic colorimetrically were made.

The Graduate Fellowship Program has been started with a graduate student from the Department of Chemical Engineering of Oregon State University. The student has been assigned to designing systems to measure dissolved nitrogen in water accurately.

Atomic Absorption Spectrophotometry

Mechanical breakdowns have continued to plague the atomic absorption instruments. Despite problems, the output on metal analyses continues to be high in number and high in quality. Analyses for selenium and tungsten were conducted on the AA instruments. The supplies, including a window, have been purchased and acquired for the analysis of mercury using flameless atomic absorption techniques.

Analysis for Carbon

Components of the infrared cell have deteriorated resulting in a loss of sensitivity. Arrangements have been made to use the O.S.U. Sanitary Engineering carbonaceous analyzer for the analysis of samples at low levels. A contract has been awarded to the Beckman Company for the modification of the 915 carbonaceous analyzer to a 315 model.

Biology

The biological section has been active in analyzing samples collected by the Regional Technical Assistance Programs. Work is also being done on samples from the NTA-Carbon studies.

Reports and Papers

Work is continuing on the writing of papers on oil pollution analysis, preservation techniques, and oxygen uptake studies.

Equipment

The Fisher Hamilton Gas Partitioner was repaired and placed back in service. The instrument now has better sensitivity than when it was first put into use.

Plans for First Quarter, FY 71

Data for production of Analytical Quality Control Charts is being programmed through a computerized system. The computer will furnish the AQC Charts. Data produced from the NTA-Carbon studies will be evaluated and correlated.

TRAINING AND MANPOWER DEVELOPMENT

910205/001

Direct Training

The following training courses were presented during the quarter:

Survey of Current Practices in Water Microbiology, April 20-24, Fairbanks, Alaska: 21 students.

Survey of Chemical Analyses for Water Quality, April 13-17, Fairbanks, Alaska; 22 students.

Biological Treatment Technology, May 11-19, Corvallis, Ore.; 21 students.

Marine Biology and Pollution Ecology, June 15-26, Newport, Ore.; 19 students. Although advanced registration in this course resulted in over-enrollment, budget restrictions caused a number of last-minute cancellations by Federal agencies.

Manpower Development

CAMPS meetings were attended in both Washington and Oregon, and the City of Portland and Seattle METRO sewage treatment plant operator training projects were monitored.

Green River Community College, Auburn, Washington, began institutional operator training in June, 1970.

Yakima Valley College, Yakima, Washington, has started an operator training program.

Clackamas Community College, Oregon City, Oregon, is including an Environmental Technology program in their curriculum.

Washington State University, Pullman, Washington, has prepared a proposal and requested funding for an on-the-job training program for sewage treatment plant operators.

A staff member met with the Mexican-American Federation in Yakima, Washington, to discuss training and employment opportunities in the water pollutuion control field.

Public Relations

Staff members spoke to schools and civic groups for a total audience of 370; laboratory tours were provided for 250 people; films and slides were loaned for viewing by approximately 2000 people; over 1600 publications were distributed. A noon book review of "Terracide," sponsored by the Corvallis Friends of the Library, was held at the Laboratory.

Plans for the First Quarter, FY 71

Marine Pollution Ecology Seminar-Juneau, Alaska.....7/29-31/70
Anchorage, Alaska.....8/4 - 6/70

Freshwater Biology and Pollution Ecology, PNWL.....9/14-25/70